bridges, Bridge A and Bridge B. The two Wheatstone bridges may be positioned such that Bridge B is rotated 45-degrees from Bridge A. The output of the MR sensor **104** may be described according to the following formulas:

Bridge A, $V_a = A \sin(2\theta) + V_{aoff}$

Bridge B, $V_b = A \cos(2\theta) + V_{boff}$

"A" may be a constant that is determined by the materials of the sensor. For example, for an HMC1512 "A" may typically be 12 mV/V. The angle θ may represent the angular position of the magnetic field. The offset may be the midpoint of the MR sensor **104** output voltage range.

FIG. **4** shows a graphical representation of an output of the Hall sensor **102**, according to an exemplary embodiment. By combining the output of the Hall sensor **102** and the MR sensor **104**, and incorporating the following algorithm, the angular position of the magnetic field (θ) may be derived according to the following formulas:

Hall sensor output>0$(V_b - V_{boff}) > 0$,

$(V_a - V_{aoff}) > 0$, $\theta = \frac{1}{2}$

$\arctan[(V_a - V_{aoff})/(V_b - V_{boff})]$

$(V_b - V_{boff}) > 0$, $(V_a - V_{aoff})$

< 0, $\theta = 180 + \frac{1}{2}$

$\arctan[(V_a - V_{aoff})/(V_b - V_{boff})]$

$(V_b - V_{boff}) < 0$, $\theta = 90 + \frac{1}{2}$

$\arctan[(V_a - V_{aoff})/(V_b - V_{boff})]$

Hall sensor output<0

$(V_b - V_{boff}) > 0$,

$(V_a - V_{aoff}) > 0$,

$\theta = -180 + \frac{1}{2}$

$\arctan[(V_a - V_{aoff})/(V_b$

$- V_{boff})](V_b - V_{boff}) > 0$,

$(V_a - V_{aoff}) < 0$, $\theta = \frac{1}{2}$

$\arctan[(V_a - V_{aoff})/(V_b - V_{boff})]$

$(V_b - V_{boff}) < 0$, $\theta = -90 + \frac{1}{2}$

$\arctan[(V_a - V_{aoff})/(V_b - V_{boff})]$

Where:

V_a is the voltage output of Bridge A,

V_{aoff} is the offset voltage of Bridge A,

V_b is the voltage output of Bridge B, and

V_{boff} is the offset voltage of Bridge B.

The offset voltage of Bridge A and Bridge B may be the midpoint of the MR sensor **104** output voltage range.

By combining the outputs of the Hall sensor **102** and the MR sensor **104**, the position sensor **100** may sense the rotation of the magnet **106**, and therefore the angular position of the rotating shaft **108**. When the output of the Hall sensor **102** is positive (Hall sensor may detect the south pole of the magnet **106**), the MR sensor **104** may detect the angular position of the magnetic field from zero to +180-degrees. When the output of the Hall sensor **102** is negative (Hall sensor may detect the north pole of the magnet **106**), the MR sensor may detect the angular position of the magnetic field from zero to −180-degrees.

The 360-degree rotary position sensor **100** may be produced as one integrated circuit package, as two separate integrated circuit packages (one for the Hall sensor **102** and one for the MR sensor **104**), or the position sensor **100** may be integrated onto a single chip. If the position sensor **100** is provided as one integrated circuit package, a preferred embodiment may be to mount the package in the fixing plane or on the rotating shaft **108** substantially along the axis of rotation. If the position sensor **100** is produced as two separate packages, a preferred embodiment may be to mount the MR sensor **104** in the fixing plane or on the rotating shaft **108** substantially along the axis of rotation, while mounting the Hall sensor **102** on the non-magnet side of the MR sensor **104** in a manner such that the Hall sensor **102** may detect the polarity of the magnetic field. The Hall sensor **102** may also be mounted substantially along the axis of rotation. Other packaging and mounting methods that are compatible with detecting the magnetic field may also be employed.

It should be understood that the illustrated embodiments are exemplary only and should not be taken as limiting the scope of the present invention. The claims should not be read as limited to the described order or elements unless stated to that effect. Therefore, all embodiments that come within the scope and spirit of the following claims and equivalents thereto are claimed as the invention.

The embodiments of the invention in which an exclusive property or right is claimed are defined as follows:

1. A 360-degree rotary position sensor system, comprising in combination:

a magnetoresistive sensor operable to generate a sinusoidal output representative of an angular position of a magnetic field with an angle range of 180-degrees; and

a Hall sensor operable to generate an output representative of a polarity of the magnetic field, wherein a combination of the sinusoidal output and the polarity provides an angle range of 360-degrees.

2. The system of claim **1**, wherein the 360-degree rotary position sensor is operable to detect an angular position of a magnetic field in an angle range of 360-degrees.

3. The system of claim **1**, wherein the 360-degree rotary position sensor system is located substantially close to a magnet, thereby the 360-degree rotary position sensor system is operable to detect a magnetic field produced by the magnet.

4. The system of claim **3**, wherein the magnet is mounted on a rotating shaft.

5. The system of claim **3**, wherein the magnet is a bar magnet.

6. The system of claim **3**, wherein the magnet is a disc magnet.

7. The system of claim **3**, wherein the magnet is composed of a material selected from the group consisting of neodymium iron boron (NdFeB), samarium cobalt (SmCo), Alnico, and ceramic ferrite.

8. The system of claim **1**, wherein the 360-degree rotary position sensor is substantially located in a fixing plane.

9. The system of claim **8**, wherein the fixing plane is a stationary plane perpendicular to an axis of rotation.

10. The system of claim **1**, wherein the magnetoresistive sensor is operable to detect an angular position of a magnetic field.

11. The system of claim **1**, wherein the Hall sensor is operable to detect a polarity of a magnetic field.

12. The system of claim **1**, wherein the magnetoresistive sensor and the Hall sensor are located substantially at a center of an axis of rotation of a rotating shaft.